The educational gradient in health: a matter of discounting?

Elise Frølich Furrebøe

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Institute of Health Management and Health Economics

Faculty of Medicine

UNIVERSITETET I OSLO

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Abstract

Socioeconomic differences in health, is a well known problem in most countries, also in Norway. Studies show that there exists a social gradient; a step-wise increase in health as socioeconomic status (SES) increases.

The objective of this thesis is twofold; first is to investigate whether there is an association between level of education and morbidity and disability among Norwegian men and women. Second, is to attempt to explain this educational gradient in health in terms of differences in discounting the future and its effects on lifestyle, which subsequently has an effect on health.

Multiple regression analysis is performed on the dataset obtained from 'Survey of living conditions 1998' carried out by Statistics Norway. The results from the analysis show that, in fact, there is an educational gradient in health in terms of morbidity among Norwegian women and men aged 60 and above. As level of education increases, morbidity decreases. The dependent variables 'Self-Assessed Health' and 'Chronic Illness' are inversely correlated to 'Education'. We also found a clear link between lifestyle-related variables such as 'Exercise' and 'BMI' and health. This is strengthened by the stronger correlation found between 'Chronic Illness' and 'Education', as compared to 'Actual Illness' and 'Education'. On the other hand, no correlation was found between 'Heart/Lung Disease' and 'Education'. Neither did we find a significant relationship between level of education and disability. However, the overall results suggest that the educational gradient in health may in part be caused by differences in lifestyle. Discounting the future, in turn, is suggested as a possible influence on this difference in lifestyle, together with knowledge. Theory about discounting is supported by studies concerning differences in discounting based on educational level. If discounting, in fact, is part of the explanation of the educational gradient in health, it has implications for implementation of policies to reduce socioeconomic differences in health, and it would be interesting to devote further research to this area.

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1. INTRODUCTION

Countries around the world are faced with socioeconomic inequalities in health. Norway is no exception in this respect. The issue is of great concern for policy makers and attempts are made to find interventions to reduce these inequalities. To gain an understanding of the causes of these inequalities, it is necessary to do explanatory research, in addition to descriptive research. This is of great importance in order to establish what the determinants of health are.

This master thesis will deal with the socioeconomic differences in health among Norwegian women and men above the age of 60. Intrigued by the fact that these differences persist in spite of the overall good living conditions in Norway, I will attempt to investigate the causes of socioeconomic differences in health, specifically differences in morbidity and disability on the basis of differences in educational level. The main research question is: Why do people with lower education, become more ill than those with higher education, other things being equal? Earlier studies on socioeconomic differences in health, have generally focused on structural conditions. There have been fewer attempts to investigate this phenomenon on a micro level. Although social gradient theories include psychological factors in explaining the existing health differences, they often fail to consider the connection between these psychological elements and people's behaviour. My main focus is to maintain an individual dimension in the analysis, explaining health differences on the basis of differences in personal attitudes, while also examining how this may be related to differences in behaviour, in this case in terms of lifestyle. In my search of finding such connections it is also important to ask questions such as: Do these differences appear in all types of illnesses? And if not, which illnesses are associated with differences in socioeconomic status? Furthermore, is there a link between these illnesses and lifestyle?

1.1 Background

Socioeconomic status (SES) has been shown to have an effect on health. Several studies describe an association between higher SES (indicated by education, occupation and income), and reduced risk of disability and illness, and longer life expectancy. We also know that the association between SES and health is found in all countries, also those with an egalitarian system and equal access to healthcare, and that the same differences are found at all levels in society (Eurothine final report 2007). There seems to be a social gradient; any change in socioeconomic status, leads to changes in health. The lower your socioeconomic status, the more susceptible you are to just about any disease. Moreover, these inequalities seem to persist in the society, even though overall health may increase. It is therefore reasonable to assume that there are other factors influencing the inequalities than poverty or the availability of health care (Marmot 2004). The concept of social gradient is concerned with the pattern of health differences among SES groups according to any or all of the indicators of SES, and how they played out relatively evenly across all levels of SES. A vast number of studies concerning social gradients show us the same results repeatedly; any change in SES is associated with a change in health. It is not a question of rich/poor, educated/not educated etc., rather it is a matter of graded differences. This means that if we in our society would be able to even out differences in for instance level of education (or other SES factors) we would obtain a decrease in the steepness of the health gradient slope (less health differences). And further, the more elements of SES differences we would be able to diminish, the flatter the health gradient would become.

We know that life style also follows the socioeconomic gradients (The World Health Report 2002). What is the reason for this phenomenon? Is it connected to the association between SES and health? In Norway poverty is more or less nonexistent, and we have a public school system which offers us equal opportunities in terms of information about the advantages and the availability of a healthy lifestyle. Still people with higher SES tend to be more concerned with the future gain of eating healthy, exercise regularly, and refraining from excessive smoking and drinking etc. (Wardle et al. 2003). Nevertheless, it has been shown that healthy lifestyle only accounts for modest explanations of the difference in health (Marmot 2004). Here it is suggested that in addition to genes, environment, health care availability and life

style, there is also a direct link between SES and health. A higher SES increases your chance of better health, by means of a psychological factor. Marmot argues that being higher in the hierarchy per se, gives us the extra psychological advantage of feeling successful and having control over your life to better whatever situation you are in, also in terms of physical health. In this context 'position in the hierarchy' refers to your own and others perception of ones value compared to others in the society and your position based on this value. Normally 'value' is understood as comprising traditional SES indicators such as education, occupation, income etc., but here I will also include other factors such as spouse's income, family background, the "right" friends/connections, special abilities, appearance, and personal traits. These are factors that may influence our 'value' depending on which society we belong to. The combination and level of the various elements that create our value, place us at different levels in this hierarchy. I will treat SES as only a part of 'value' in this paper.

1.2 Hypothesis

My hypothesis is that higher SES, and higher education alone, leads to better health in a graded fashion through two effects, one direct effect and one indirect effect:

1. Direct effect: SES has a direct effect on health, because this status, together with other factors mentioned above, gives us a value and a position in the hierarchy. It tells us something about how much we are worth according to our own and others opinions. The feeling of being worth more, relative to others, leads to better self-esteem; you become confident, successful, and in control of your own life. An unsuccessful person is a less healthy person. Or, as Marmot puts it: 'Imbalance between effort expended and reward gained is psychologically damaging and hence damages physical health (Marmot 2004:20)'. As mentioned, your value can increase or decrease by a large range of factors such as; career, income, spouse's income, family background, the "right" friends/connections, special abilities, appearance, and personal traits. Being successful in one way or the other, according to your self and in the view of others, is the main objective. Income is (correctly or not) an indicator of how successful you are, and therefore influences your value. Higher education is another such indicator. It is not always associated with the highest wages, but higher

education in itself gives you a higher SES, and thus a higher value (at least in most societies). The health differences due to differences in SES appear in a graded fashion, because your value, based on SES and other factors, is graded. It is your success *relative to* others that matters.

So far, I agree with Marmot. But in addition to the direct effect, I will argue that the psychological advantage of having a higher value and being positioned higher in the hierarchy, also affects health indirectly through an increased focus on lifestyle. Also this dimension appears in a graded fashion, in 2 steps; through relative value, as above, but also through relative discounting. Discounting refers to the psychological mechanism of placing less value to events in the future. Because people are impatient by nature and because the future always is more or less uncertain, the present is normally valued higher than the future, and the further into the future we peer the more we tend to discount. Moreover, it is reasonable to believe that people who have less opportunities, have a feeling of less control over their lives, or have a weaker belief in their ability to affect their future, actually discount the future more. The ability to affect ones future is often referred to as self-efficacy.

2. Indirect effect: Higher SES (and thus higher value), leads to a stronger feeling of control over your life, which in turn leads to less discounting of the future and therefore a stronger focus on a healthy lifestyle, which we know leads to better health. The higher income, education, position etc. you have, the easier it is to choose how to live your life and the clearer you see the effects of your choices. In other words, those of higher SES have a stronger emphasis on the future and a stronger belief in the effect of a healthy lifestyle. The higher the SES, the less discounting, and the more focus on behaviour that brings future gain; i.e. leading a healthier life so to prevent illness, by eating right and exercising, and refraining from smoking/drinking, and perhaps also taking more care of one self by being involved in activities that give you pleasure or some other advantage in the long run; cultural activities, travel, friends etc. The difference in value/success, based on SES and other factors, has a graded effect on discounting, again due to the large number of elements that contribute to the relative value. Also the discounting is relative and thus has a graded effect on how healthily adjusted our lifestyle is.

Marmot (2004) argues that the presence of the health-gradient partially explains the direct psychological effect SES has on health. His point is that even if we account for all the SES factors separately, there is still the effect of the SES itself, explained by a 'general susceptibility' to illness among lower SES groups. SES probably affect our self-esteem and our feeling of control, but I would like to make an attempt of showing that this psychological effect in combination with a healthy lifestyle, primarily through discounting of the future, is the explanation of the gradient pattern of inequality in health across different SES groups in the society. In my opinion, our behaviour is influenced by our attitudes and our attitudes are formed, among other things, by our surroundings. I believe that health differences can not be explained by differences in self-esteem, without looking at how these attitudes affect our behaviour, and how our behaviour affects our health. Therefore, I will emphasize the connections between SES and discounting, and the connection between discounting and lifestyle, discounting being the attitude, and lifestyle being the behaviour. Discussions about SES and health differences have evolved around psychological determinants for some time. Thus, the inclusion of such theories as future discounting and rational addiction seems inevitable. Including these theories will hopefully contribute to a more comprehensive picture of the mechanisms involved in forming the social differences in health.

1.3 Method

To obtain the most relevant research findings in the field of socioeconomic inequalities in health, I have searched internet sites such as Medline and British medical journal for resent articles, in addition to library search for additional literature on related subjects, to support and to argue against Marmots theories. There is a vast amount of literature on the subject, particularly in terms of SES differences and *mortality,* less on morbidity. I have primarily focused on studies where educational level is the SES indicator, but other SES indicators are also covered. In terms of health, both mortality and morbidity serve as indicators of health in the selected studies. I have selected articles and reports so that supplement studies from Norway and that are from other countries that Norway is comparable to.

In the attempt of investigating the associations and causal effects between level of education and morbidity and disability, I will perform a regression analysis using SPSS. The data set used is obtained through 'Survey of living conditions 1998'. It is a survey carried out by Statistics Norway, where the subjects answer various questions about their lives, including health status, working situation, lifestyle etc. The final response count after missing cases, death, denial, ended at 3449 people with whom they obtained an interview with. The selection is assumed to be representative to the population in Norway, the data collection being carried out by the Statistics Norway, and in doing so obtaining a demographic spread of people from all counties of Norway, across all ages, from both genders and from both city and rural areas in a sufficiently large sample. We should therefore be able to generalize the sample results to the population at large. However, the weakness is that we can not be certain whether non-response have occurred on the basis of relevant variables such as SES, which might confound the sample and in turn undermine generalization of the findings . Another weakness is that all the data gathered on illnesses and lifestyle habits are based on self-reported answers through interviews. This, of course, raises the question of measurement validity; do the subjects answer truthfully? People may be reluctant to report on delicate matters like diseases for instance. However, previous surveys with similar results strengthen the validity of the survey. Looking at the research design, there is an additional problem concerning internal validity. The cross-sectional study implies that all the data are collected at the same time. The causal effect is therefore difficult to establish, compared to what would be the case with a longitudinal study. A cross-sectional study also means we don't have control over spurious relationships. To subdue this effect, as many as possible of the variables influencing both dependent and independent variables, are included.

The majority of studies concerning the association between SES and health have been executed using mortality as the indicator of health. Several studies of this kind have been performed also in egalitarian countries, such as Norway. I will, in this study, use morbidity and disability as indicators of health, expecting to find similar associations as previous studies on mortality, and hopefully some additional details about what types of illnesses that make up the difference in SES groups. To explain morbidity I will first use 'Self-Assessed

Health' as the dependent variable and look at how this is affected by variables such as education, exercise, smoking habits and body mass index (BMI), controlling for age and gender. Education being the indicator of SES, and the rest of the independent variables are indicators of lifestyle. The findings will then be analysed and compared to findings with 'Actual Illness' (any disease), 'Chronic Illness', and 'Heart/Lung Disease' as dependent variables explaining morbidity, and 'Disability' as the dependent variable explaining disability. The same independent variables of SES and life-style are used here. Education is used as an indicator of socioeconomic status, rather than income or occupation, because education is a more fundamental determinant, as it also partly determines income and occupation. In addition, I believe that education is more 'personal' and for that reason it is a more precise indicator of your socioeconomic status, and it is more persistent over time. Occupation and income are easily influenced by other factors such as demand for particular occupations at certain points in time. Educational level is therefore more suited for explaining any relationship between health and SES or a personal 'value' and position in the hierarchy. Selected cases in the analysis are Norwegian men and women 60 years of age and above, to strengthen the probability that the SES indicator of education being a predictor of morbidity and disability, and not visa versa.

I expect to find a correlation between higher education and better health through less disability and fewer incidences of diseases, both overall illness and diseases related to lifestyle such as heart-diseases, cancer, diabetes and obesity etc. An inverse correlation between higher education and all types of illness would strengthen both Marmots theory and the direct effect in the hypothesis of this paper. An inverse correlation between higher education and life-style related diseases/ chronic diseases would strengthen and support the indirect effect.

1.4 Structure of the thesis

In the continuation of the thesis the following will be covered: I will begin with a theoretical framework in the next chapter, exploring the latest reports and studies about SES and health inequalities in Europe. In chapter 3, I will describe the current situation in Norway in terms

of general demographic changes and specific health-related tendencies. In chapter 4 the hypothesis is tested against empirical data; first the dependent variables and a correlation between them is presented. The independent variables are presented next, followed by a presentation of the statistical model and the regression results. In the concluding part of the thesis, I will interpret and discuss the findings of the regression analysis in light of previous results.

2. THEORETICAL FRAMEWORK

This chapter will give an overview of current studies addressing topics relevant for this thesis. The primary focus is on reports describing and explaining the social health differences in Europe and Norway, both concerning SES in general and specifically related to level of education. Secondly, I will go through theories of social gradients in health. The Whitehall studies have been of particular importance in gaining insight into non-medical determinants of health, and for that reason it is given special attention. Further, theories about SES and lifestyle are evaluated to make an attempt at explaining an alterative, indirect link between SES and health. Lastly, theories about future discounting are included, because I believe this might provide an explanation for the differences in lifestyle between individuals based on their level of education.

2.1 Health inequalities in Europe

The EUROTHINE project: 'Tackling health inequalities in Europe' was an international collaboration that aimed to increase our understanding of health inequalities in the European Union. It started in 2004 and lasted until august 2007. Department of Public Health, Erasmus MC, University Medical Centre Rotterdam, Netherlands coordinated the project in which many universities from around Europe participated. The report gives us valuable insight into the presence of health inequalities across Europe. A selection of studies from this project is used here.

2.1.1 Health inequalities are present everywhere

One of the studies in the EUROTHINE project is called: 'Socio-economic inequalities in mortality and morbidity: a cross-European perspective (J.Mackenbach et al. 2007)'. In this study inequalities in mortality and self-assessed health were compared between 22 European countries. The data on mortality was obtained by longitudinal and cross-sectional mortality studies. The self assessed health data was obtained by interview or multipurpose surveys. Because Europe consists of countries with quite diverse political, cultural and economical history, this offers a unique opportunity to study health inequalities and whether these

inequalities are modifiable. The study found that mortality was always higher in lower socioeconomic groups (indicated by education, occupation and income), but the magnitude of the inequalities varies significantly between countries. Also, morbidity was higher in lower socioeconomic groups, in all countries, but the differences between countries are smaller and less clear than is the case for mortality. The most surprising finding perhaps is that there was no indication of smaller inequalities in northern Europe than elsewhere in Europe, despite of these countries' particular engagement with reducing socioeconomic inequalities over the past decades through a social-democratic regime. This study suggests that 'new' life style-related risk factors are part of the explanation for this consistency, and that greater investment in health promotion and other approaches to reduce exposure to unfavourable consumption patterns are needed.

2.1.2 Health inequalities according to educational level

Similarly, another study (Eikemo et al.2007) shows that Scandinavian countries also have health inequalities, although not as large as countries in southern regions of Europe. The study examined whether the magnitude of educational health inequalities varied between European countries with different welfare regimes, based on self-reported health in terms of both general health and longstanding illness. It was found that health inequalities were smallest in Bismarckian countries and largest in the southern Europe where the lowest average educational level is apparent. In the Scandinavian countries welfare benefits seem to have a protective effect for the disadvantaged, but that other factors such as class patterns and relative deprivation may contribute to persisting inequalities. And some argue that the relative deprivation is a result of expectations and comparisons with other individuals and groups, and that this effect may be stronger in the Nordic countries were social mobility is more prevalent in comparison to other countries. In one such study (Yngwe et al. 2003, mentioned in Eikemo et.al 2007:184) they formed 40 reference groups and compared their relative income and their self-rated health. The results showed an effect of relative deprivation on self-rated health, and more so among those in the population with higher income. However, there may be other factors involved. For instance immigration may also be part of the explanation. Immigrants are often amongst the least educated in the society, and they often report lower self-rated health. On the other hand, one might view the matter of being an immigrant as part of the SES position in the hierarchy. One study (Huisman et

al.2003, mentioned in Eikemo et al. 2007:183) reported that there were large inequalities in health according to education in older men in Denmark, but smaller inequalities among women. If Marmots theory holds about 'your place in the hierarchy's effect on health, one would expect the same findings also in other countries, considering how a woman's status traditionally has been associated with their spouses' status. Others (Dalstra et al.2005, mentioned in Eikemo et al. 2007:184) have investigated chronic conditions, specifically. Comparing 8 European countries, there were not found any larger or smaller health inequalities in the southern countries as compared to Bismarckian countries. This supports the hypothesis that the association is between chronic diseases and lifestyle (and likely SES), rather than between chronic diseases and different countries and the quality of health-care, or poverty for that matter. These studies on morbidity are confirmed by previous studies on mortality differences by educational level.

2.2 Health gradients

The health gradients refer to the incremental change of the socioeconomic hierarchy that is associated with improved health outcomes. Several studies have concluded that there appears to be such a gradient in all societies. One important contributor to this research field is Michael Marmot, who conducted the Whitehall studies in Britain (Marmot et al. 1991, mentioned in Marmot 2004: 38). He found that there is a social gradient in health that runs from those positioned lowest to those positioned highest in the hierarchy. In other countries studies have lead to the same conclusion, but what the determinants of the social gradient of health are, is still debated.

2.2.1 The Whitehall studies

There are two Whitehall studies. The first, The Whitehall I study, started in 1967 which lasted 10 years. It studied 18 000 male British civil servants from the area of Whitehall in London. In the Whitehall there are clear differences between grades in income, education, and the nature of the job, which provides a highly stratified environment, but it is a relatively homogenous group; excluding the richest and the poorest in the society and the unemployed. Even in such a homogenous group social gradients in health appear very clearly. Subtle differences in social ranking were found to be associated with dramatic differences in health

among these people. The men from the lowest employment status groups had a three-fold higher mortality rate than men in the highest groups. The second Whitehall study was set up to determine the underlying agents of this social gradient in death and disease and to include women. The Whitehall II was a longitudinal, prospective cohort study starting in 1985. It examined 10 308 men and women also employed as British civil servants from Whitehall. This study concluded that there were similar gradients in morbidity in both women and men, and the social gradient was observed over a range of different diseases.

Marmot argues that SES affects our health, not only between the poorest and the richest, but also amongst everyone in between (Marmot 2004). Further, he argues that these health differences can be explained by more than mere health-care availability, life-style, background, or money, but also by our position in a social hierarchy, which influences control over life and opportunities to participate fully in society. Health care availability probably has an effect on health inequalities in such that all types of diseases were more common in the lower classes, but in countries like Norway, and England where the Whitehall study took place, health services are equally available to all. And in general, medical care has an effect on survival, not so much on illness. One might argue that the higher you are in the hierarchy, the more you make use of the available health care services. In that case, I think it has to do with the 'future-gain-thought' – the more feeling of control over your life, the more concerned you are of preventing illness. However, studies show that access of health care follows the incidences of illness and in cases of particular diseases more health care was offered to those lower in rank, because they were more ill. Life style does indeed follow the social gradients. The lower you get in the social hierarchy, the more likely it is you smoke, the less likely it is you exercise and have a healthy diet, and the more prone you are to diabetes, obesity and heart disease. However, Marmot suggests that these differences only account for about 1/3 of the explanation of the social gradient in health. I.e. a smoker from a lower class has a higher risk of heart disease than a smoker of a higher rank. Your background; your parents' status, upbringing, environment, genes etc., might also have an effect on our health. We know that our background affects where we end up in the social hierarchy, but it seems to be where we end up in the social hierarchy that determines our level of health, and not our background. The Swedish social scientist Robert Erickson studied male mortality according to level of education, and found a clear association between

higher education and lower mortality, but taking into account fathers' social class had little effect on the result. This supports the idea that it is not your background, but where you end up, that has an effect on health. Then there is the question of what money can buy. Level of income is one SES factor and is obviously associated to health; the lower the income the higher probability of bad health. But when we are not dealing with poor people at all in an egalitarian society, we can not explain this relationship by what money can buy. Marmot suggests that it is how much money you have *relative* to others that matter. Money is therefore a marker of success, rather than the means of purchasing health services. Hence, according to Marmot there is one additional factor that explains the pattern of SES and health, besides healthcare availability, life style, background and money; there is a direct association between your place in the hierarchy and health. A higher SES gives an advantage beyond material gain. The psychological advantage of being successful actually has a substantial effect on your well-being and overall health. But if the social gradient of health is explained by psychological factors, one might argue that it is likely that we see the same tendencies across all types of diseases. Differences in genes, environment, health care availability, and how healthy a lifestyle you lead, would lead to differences in certain types of diseases. It actually seems to be true in many cases, that the lower you are in the social hierarchy the more susceptible you are to *any* disease. Even in cases like for instance heart disease, which has for a long time been thought of as an illness of the rich, it is now more common the lower you get in the social hierarchy. In the Whitehall study the social gradient was observed for a range of different diseases, and thus supports this explanation. Other studies show different results.

2.2.2 Educational gradient in health in Norway

The study 'Contribution of specific causes of death to educational differences in mortality (Elstad et al. 2007)' analysed causes of death for men and women aged 25-66 living in Norway in 1993, on the basis of educational level. Also here they found a gradient of health through the whole spectre of education from the lowest to the highest for all causes of death; a systematic pattern where the Odds Ratio for death increase at each step down the educational scale. The gradient is stronger for men than for women, and there are some variations in type of illness causing death. For chronic lung diseases, heart diseases and alcohol-related diseases the gradient was steeper, and for a few types of cancer, such as

colorectal cancer the gradient was almost absent. The fact that the health gradient appears throughout almost all types of diseases, strengthens the hypothesis of a general susceptibility; and that factors such as unhealthy lifestyle, less resources to tackle psychosocial stress etc. are the explanations of the health differences. On the other hand, the fact that some diseases (i.e. colorectal cancer) yield very little difference across educational levels indicates that there must be other explanations than the psychological effect of placement at different positions in a social hierarchy. Perhaps some diseases are determined by psychological factors to a greater extent than other diseases? Or some situations or individuals may be more susceptible to the psychological factors? Bjørgulf Claussen, coordinator of the project 'Storbyhelse' discusses this in the article: 'Social inequalities in health in Oslo (Claussen 2007)'. He argues that social inequalities in health are due to both psychosocial and materialistic conditions. The psychosocial mechanisms can explain the relative social differences in health. The experience of being successful (i.e. being higher in the hierarchy) will in this case influence your health. But this explanation does not exclude the explanation of association between absolute income and health, were it is your materialistic opportunities that protect your health. Claussen suggests that the psychosocial mechanisms explain the health differences between those at the top of the social hierarchy and that the materialistic conditions explain the health differences in the lower part of the hierarchy. Both explanations have to do with security and control over life. The psychological explanation of social gradients gives support to the direct effect in my hypothesis. However, I do believe this psychological advantage leads to better health also through the indirect effect of leading a healthy life.

2.3 Socioeconomic status and lifestyle

In the industrialized world there are great differences in lifestyle between those of higher and lower SES (The Word Health Report 2002). Under-nutrition is obviously strongly associated with lower SES through absolute poverty. On the other hand we have over-consumption of certain food components, and obesity. This phenomenon was initially found among the higher SES groups, but as countries go through transitions of economic development, the patterns reverse, and obesity is now associated with lower SES in industrialized countries. Overweight and obesity is of course closely linked to physical inactivity and bad eating

habits. The same transition pattern is found in tobacco and alcohol consumption. A healthy lifestyle can substantially reduce the disease burden worldwide, represented mainly by chronic diseases such as heart disease, stroke, cancer and diabetes. According to WHO (The Word Health Report 2002), low fruit and vegetable intake is estimated to cause about 19% of gastrointestinal cancer, and about 31% of ischemic heart disease and 11% of stroke worldwide. Physical inactivity is estimated to account for, globally, about 10-16% of cases each of breast cancer, colon and rectal cancer and diabetes mellitus, and about 22% of ischemic heart disease. Among industrialized countries smoking is estimated to cause over 90% of lung cancer in men and about 70% of lung cancer among women.

2.3.1 Physical activity

People of higher SES tend to be more physically active than others. Some studies suggest that the reasons for these inequalities are related to leisure-time rather than work-related activities; inequalities in access to facilities and opportunities for activities in the community (Branca et al. 2007). People of higher SES have more money and more leisure –time to spend on these activities, and are exposed to more social pressure to exercise. In addition, they may know more about the positive effects of physical activities (Wardle et al. 2003, mentioned in Roskham, Kunst, 2007). Lower SES groups tend to spend more time watching TV and using the computer, and thus less time is left for physical activity. One study (Demarest et al. 2007) show that in Northern European countries the prevalence of sedentary lifestyle is rather low compared to other European countries, yet distinct socioeconomic differences can be observed. Of course, leisure time physical activity is only part of the physical activity picture. Nevertheless, it gives us an indication of how much people are physically active. In light of how much more sedentary our working conditions have become throughout the years, it is even more important to emphasise leisure time physical activities.

2.3.2 Dietary habits

It is indicated that people of higher SES also tend to have healthier dietary habits. Studies show that people with higher education have a higher intake of fruits, vegetables and fish, and a little lower intake of fat (www.shdir.no). Furthermore, these differences appear in a graded fashion. There is also evidence that children of people with higher education eat more

nutritious meals and more regularly, and they seem to be more content with their own body, compared to children of people with lower education. A healthier diet may be more common among the higher SES group for similar reasons as for physical activity; a better knowledge about the positive effects and social pressure to eat healthy. There may also be an economic factor, even in rich countries. There is an easy access to low-cost energy-dense foods, which cause those not too concerned about eating healthy (lower SES group) to choose the cheap and easy solutions (Darmon N, Drewnowski A. 2008). Generally, modernization and globalization have lead to changes both in terms of physical exercise and nutrition, but the impact of these factors differ across SES groups. Since food is as price-sensitive and income-sensitive as it is, relatively poorer people choose the cheaper energy-dense food alternative (Popkin 2003, mentioned in Roskam, Kunst 2007) while at the same time modernization has lead to a decrease in work-related and leisure-time physical activity. This, in turn, leads to a general increase in the prevalence of overweight and obese people across all SES groups, but at a grater rate among the lower SES groups.

2.3.3 Smoking

Yet another study in the Eurothine report (M.M. Schaap et al. 2007) concludes that smoking prevalence is related to educational level as well as to occupational class and measures of accumulated wealth (other than income). It is suggested that smoking is a way of coping with deprived living circumstances and stress. Less perceived influence on work, which is associated with lower occupations, has been shown to prevent successful cessation of smoking. This is in line with Marmots theory which explains the inequalities in health by the lack of control over your life in the more deprived groups of people.

In a country like Norway, we all have the opportunity to live healthy lives. Presumably, we all have the knowledge about the effects of leading a healthy life, and we have the money and the availability of resources necessary for exercise and a healthy diet. I am therefore inclined to think that there are attitude differences across SES groups that lead to differences in lifestyle, which, in turn, lead to differences in health. For instance, is it possible that people from different SES groups discount the future differently?

2.4 Socioeconomic status and future discounting

2.4.1 Standard discounting

Marmot and others suggest that a lower SES is associated with weaker self-efficacy. If that is the case, one would think that those of lower SES to a larger degree engage in discounting, than those of higher SES. Standard discounting means future consumption/costs/rewards are emphasized less than current ones, in a time-consistent fashion. The relative emphasis remains the same, and thus the discounting is exponential. Present-biased preferences, on the other hand, is a time-*in*consistent discounting (O'Donoghue and Rabin 1999), which means you give stronger relative emphasis to the earlier moment as it approaches, when considering trade-offs between two future moments. This discounting is hyperbolic, the relative weight changes as time goes by. This hyperbolic discounting may explain phenomena such as procrastination, where doing it tomorrow rather than today has a *large* step in utility compared to the rest of the time perspective. This can also be applied to situations of life-style, and may for instance explain procrastination of changes to better lifestyle habits, but it doesn't explain the inequality between SES groups. This, I think, can be explained by the standard discounting.

People are impatient by nature, and we want to experience rewards soon and to delay costs. It is however reasonable to believe that people who have a feeling of little control over their lives, have a greater focus on the present and on immediate gratification of say continuing to smoke or eating favourite (unhealthy) food, and less on the future advantage of not doing so. Therefore, I think it is a time-consistent discounting that may explain the differences among SES groups and not the time-inconsistent discounting. Studies have shown that people of low SES, for instance low-income single mothers, continue to smoke even though they know it is unhealthy, because it is about the only luxury they have. Giving up that single present "treat" to obtain a discounted good (healthier life) in the future, may not be attractive enough when the future is uncertain, which it is when you don't have control over your life. How much do you discount a good thing, when it is uncertain if this 'good thing' will ever appear? Is it then a rational decision? I would say so.

Daly and Wilson (Daly M, Wilson M. 1997) have compared homicide rates in Chicago neighbourhoods, and found that life expectancy (cause deleted) and economic inequality were correlated to homicide. They suggest that the steeper discounting that occurs among those of lower income and lower life expectancy is rational because it is a response to information that indicates uncertain or low probability of surviving. One would think that there is the same effect on health; the more control you seem to be having over your life, the less discounting occurs. Higher SES might affect inclinations to invest in the future, by leading a healthy lifestyle. It is a rational choice based on the knowledge that there is a high probability of earning a reward in the future by what is done today.

2.4.2 Rational addiction

In the theory of rational addiction (Becker GS, Murphy KM. 1996) it is proposed that even strong addictions are really rational in the sense of involving forward-looking maximization with stable preferences. They also claim that people get addicted to, not only alcohol, gambling, cigarettes and narcotics, but also to eating, work, music, exercise and many other activities. They stress that addictive behaviour is determined by whether steady-state consumption levels are stable or unstable. Unstable steady states are crucial for addictive behaviour. They show, for instance how situations like divorce, unemployment and similar tension-raising events affect the demand for addictive goods. Their analysis implies that present-oriented individuals are potentially more addicted to harmful goods than future oriented individuals. The reason for this is that an increase in past consumption leads to a smaller rise in full price when the future is more heavily discounted. They distinguish harmful from beneficial addictions by whether consumption capital has negative or positive effects on utility. The depreciation rate on consumption capital *raises* the demand for harmful goods but *lowers* the demand for beneficial goods. If you are addicted to jogging, you therefore tend to be future-oriented. So, we presume that lower socioeconomic status leads to a greater degree of discounting, which in turn leads to:

A) A greater probability of harmful addictive behaviour.
B) Less focus on healthy habits.
C) Disbelief in ability to move out of your SES group.

In other words; individuals in a lower SES group you are more or less trapped. The best solution to avoid health differences between SES groups seems to be to prevent people, particularly those of lower SES, from starting to smoke and eating unhealthy, because once started it is hard to stop. Preventing these habits must be done by focusing on a more future oriented view, together with knowledge about the benefits of a healthy lifestyle.

2.4.3 Discounting in a graded fashion

The explanation of discounting the future is logical when it comes to poorly situated people, but it is harder to understand that a well educated person with an average income in Norway feels that he/she does not have control over their life to the same extent as a person with a slightly higher wage or education. Most people in Norway have the opportunity of social mobility, and if you're not satisfied with the situation you may do something about it. On the other hand, the opportunity of social mobility may also have a negative effect, in the sense that the opportunity creates a *pressure* of mobility. In societies such as Norway there are no excuses for not doing well for your self. You have every chance of succeed, and the fall is therefore greater when you fail. So, even if you are doing quite well, it might not be good enough relative to others. This is where the gradient pattern comes into place, in my opinion; a small increase in any of the elements that give you status, push you upwards in the hierarchy. Relative to others in the hierarchy, you have obtained a higher ranking, a higher degree of confidence and feeling of control, which then in turn gives you a *relatively* greater focus on the future (discounting less), and leads thus to more concern for, and perhaps a greater desire to know more about healthy behaviour.

If it is true that some people, in fact, do discount the future to a larger degree than others, it is not so peculiar to think that those who discount less are the same people who have higher education. To make a choice of continuing your education in stead of getting a job, must necessarily mean that you believe in, and want to invest in, the future. You forsake a steady job and income now, for the sake of a better job and income in the future. Further one might argue that this 'belief' or the ability of self-efficacy is taught by parents and that your background in this way also has its effect. In that case, information is of great importance, to influence those of lower SES to actually believe that there is a reward in the future even if

you don't see the result instantly. If you never experience such a future reward, or never have been told about the chance of earning one, you will not believe in it, and will continue to indulge in efforts with immediate rewards, rather than future (and perhaps larger) rewards.

In addition, people with higher education are probably more used to considering new knowledge. Knowledge about health, diet and exercise evolve continuously, and perhaps people with higher education are more adaptable in the sense that they are more prone to make use of new knowledge. Conversely, the lower the education, the more 'static' and less open for new information, you may be.

2.5 Summary –theoretical framework

Fig.2.1 shows the causal relationship between SES and health, including both materialistic and psychological explanations. It is a schematic presentation of how I believe the causal relationships between SES and health normally is understood. The boxes show the Socio economic status variables, and the arrows are the causal effects. The pyramid is the social hierarchy that Marmot talks about, in which we all are placed, according to our total SES.

Fig.2.1 Causal model of the relationship between SES and health.

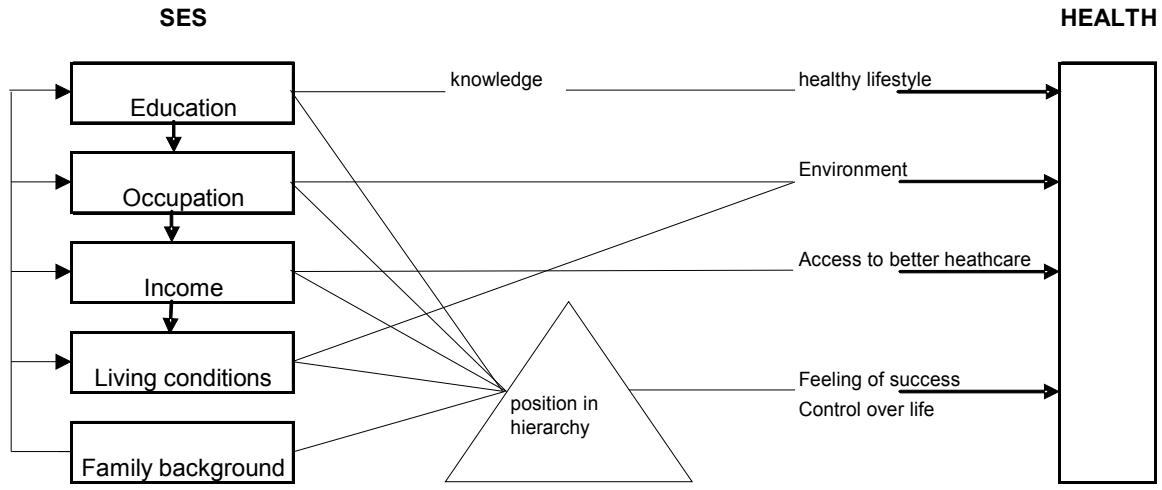
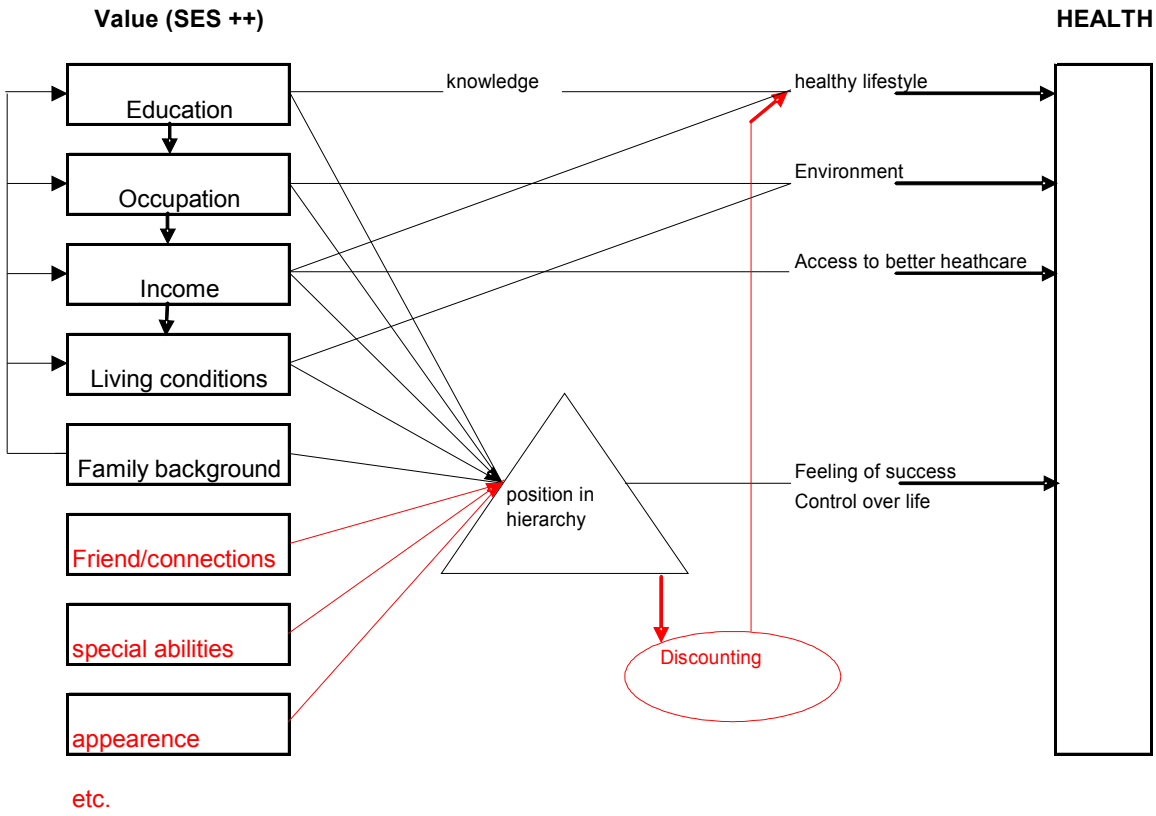


Fig. 2.2 corresponds to the hypothesis of this paper. In addition to the same SES variables as in fig.2.1, indicated by boxes, there are boxes for other variables included. All these variables (boxes) together form our value which places us at different levels in the hierarchy. Here the pyramid is also the social hierarchy, and the arrows are the causal effects. The direct effect is represented by the arrow from the pyramid to health. The indirect effect is the arrow from the pyramid via the ellipse to health. The ellipse shows the discounting that I believe occurs at various degrees based on what position in the hierarchy you are placed, which again affects our lifestyle and knowledge about it, and in the end our actual health.

Fig.2.2 Causal model of the relationship between SES and health, including discounting.



The main feature of this thesis, visualized in fig.2.2, is the additional effect of discounting and how it is connected to SES and health through lifestyle; our knowledge about it and how we act upon it. Neither the theories of medical and environmental determinants of health, nor the theories of non-medical determinants such as Marmots explanation about 'your place in the hierarchy', are rejected. Instead, they are supplemented by the theory of discounting and

self-efficacy, and thus expanding the picture. The link between the hierarchy and health has been overlooked, in my opinion. Hence, an additional step has been added; the explanation of difference in discounting on an individual level.

3. THE SITUATION IN NORWAY

In this chapter I will try to account for those conditions prevailing in Norway, which are relevant as a background for the discussion around the determinants of health. SES and health inequalities in Norway should be seen in light of both the current situation with regard to institutional concerns and according to matters of our general conditions of wealth, lifestyle and health.

3.1 Institutional concerns

3.1.1 An aging population

Data from Statistics Norway (www.ssb.no) show that the population of Norway pr. oct.1. 2008 was 4 787 000. 19% of age 0-14, 66% of age 15-65 and 15% of age 65 and above. Life expectancy at birth (in 2007) was 78 for men and 83 for women. There is a population growth of 0.363%. As for most Eur-A countries, Norway has an increasing proportion of elderly people. According to WHO estimates (www.who.int) the number of people aged 65 and over is expected to grow from about 15% to about 22% in 2030. As the population ages, it becomes increasingly important and more interesting to study this group.

3.1.2 National income

Numbers from WHO (www.who.int, World Health Statistics 2008) show that in Norway the per capita gross national income, adjusted for purchasing power parity, was the highest among Eur-A countries. In 2000 3.4% of Norwegian children were living in relative poverty (relative poverty being the indicator of income below 50% of the average national income.) Relative poverty is very low in Norway and it continues to drop. The relative poverty in terms of the deviation from a perfectly equal distribution, given by the Gini index, shows that Norway is at 25.7, the top being Sweden at 25 and the bottom being Italy at 36.

3.1.3 Education

The Norwegian educational system consists of 10 years of compulsory school (grunnskole) for children age 6-16. After which everyone has the right to continue their education with 3 or 4 years of high-school (videregående skole). This can either be a preparation for university and university-college, or provide training for a skilled trade (fagbrev). However, until 1969 the Norwegian school system was divided into compulsory grade 1 to 7 (folkeskole) and one additional year (framhaldskole, grade 8) or 2 additional years (realskole, grade 8-9). After 'realskole' one could go on to 'gymnas' (grade 10-12), which is the equivalent of today's high-school. That is the reason we se a lot of people in Norway above the age of 52 who have 7 or 8 years of education.

It has been a political goal in Norway to provide equal opportunity of education to all, independent of gender, geographical location, or social or cultural background, and all education from grade 1 through high school is free. The level of education has increased steadily over the last decades (www.ssb.no/utdanning). Today about 90% of all 16-18 year olds are attending high school. The number of drop-outs is a little higher for boys (29% in 1999) than for girls (20% in 1999). Since 1980, the majority of students in Norway have been women. 35% of women aged 19-24 are attending university or university-college, while only 24% of men the same age are students. For other European countries there is also a majority of women in higher education. Traditionally, students have been men from urban areas with parents who also have higher education. This has changed over the years, and an increasing number of men, and later also women, from rural areas attended universities and university-colleges. But up until 1971 nearly 70% of all students were men. (www.ssb.no/utdanning)

3.2 Wealth, lifestyle and health

3.2.1 Income and Employment

In 2001 the average income pr. household in Norway was 415 000 kroner (www.ssb.no/arbeid). This is an increase of 100% from 1986. 74% of this income is made up of salaries/wages, which has decrease the last few years. During the same period the share of pensions and insurances has increased. In 2006 the average income pr. person was on average 293 200 kroner. The average wage for women working full-time was about 86% of men's average wage in 2002, and has been stable up until now. Also, fewer women work full-time, so that their average income is actually only about 60% of men's average income. In 2002 still only 56% of women work full-time. Among men the number working full-time has been stable at about 90% for decades. Overall average income has increased over the years, but the gap between low and high income is widening, mainly caused by the richer getting richer. Unemployment rates were high during the 1980's. At this time the gender inequalities also levelled out, and during the 1990's the unemployment rates for men exceeded that of women. The reason is, among other things, the fact that many women work in public services which is less affected by economic trends. In 2007 the unemployment-rate for women was 2.5% and for men 2.6%.

3.2.2 Lifestyle

Resent reports from The Norwegian Directorate of Health (www.shdir.no) show positive trends of dietary habits among the people of Norway, and a rather negative trend in terms of physical activity. From the 1970's and until the 1990's the content of saturated fat in food has decreased. However, since the 1990's it has levelled out. At the same time the amount of fruits- and vegetable-consumption has increased substantially since 1975, and sugar consumption has decreased from 43 to 35 kg per year since 2000. This seems to have a direct association with a decrease of about 70% in heart disease mortality. Unfortunately the prevalence of cancer, obesity and diabetes 2, is still increasing. Particularly diabetes 2 is often caused by obesity and inactivity. Physical inactivity is an increasing problem, in Norway as in any other country, because the great changes in working-conditions make it easy to become very inactive. Tasks that previously required substantial physical labour have

now been replaced by sedentary jobs. With the same energy-intake and lower physical activity, people of today become fatter.

Escalating body-weight is a problem throughout the world, developed and developing countries alike. The development is the same in Norway as in the rest of the world. People in all weight groups have a higher Body mass index (BMI) today than they did 10 and 20 years ago. BMI is an expression of weight compared to height, and according to WHO (www.who.int) normal weight (BMI) is between 18.5 and 24.9. Underweight is below 18.5. Overweight is between 25 and 29.9, and obesity is above 30.

A study by Norwegian Institute of Public Health (fhi.no) show that among 40-45 year old people in Norway, men weighed on average 5 kg more, and women weighed on average 5.8 kg more in 2004 than 15 years earlier. The study was conducted in five counties; Oslo, Hedmark, Oppland, Troms and Finnmark. In the group of people between 40 and 45, 14-22% of men and 13-20 % of women were obese. They found that there is a higher degree of obesity among those with lower education.

Comparing the data from 2004 with earlier studies shows us the development in people's weight in Norway the last 30- 40 years. The weight of men has increased steadily since 1960, the weight of women has increased since 1985, and the latest reports confirm that it keeps increasing and that the same trend applies to all ages. The increase in weight also seems to get steeper from 1995. Overweight and obese people have greater risk of diseases such as diabetes 2, heart diseases, and certain types of cancer. But a lower risk of osteoporosis. This development towards higher body-weight is due to changes in the environment and changing lifestyle. However, studies show that greater weight-reduction over time is difficult to obtain by lifestyle changes alone, and preventive actions are therefore of vital importance.

3.2.3 Diseases

Numbers from Statistics Norway 2005 (www.ssb.no/helsetilstand) show what types of diseases are most common in Norway. When including both genders and all ages the most common diseases are in the category skeleton and muscles (24%), heart diseases (16%) and respiratory disease (17%). These are also the categories that increase by age together with eye/ear diseases and 'other diseases'. There are however some gender specific differences. While heart diseases seem to have the same prevalence among women and men, both skeleton/muscle diseases and 'other diseases' are more common among women. When it comes to cause of death, heart diseases has been the most common both for women and men since 1950. During the years 1970-80 more than 50 % of all deaths were caused by heart disease. After 1980 this number has decreased slightly. Cancer, on the other hand, has increased steadily, and was at about 25.4 % for men and 21.9% for women in 2000.

4. MULTIPLE REGRESSION ANALYSIS

In this section I will test my hypothesis against empirical data. The purpose of the analysis is to investigate the causal effect of several independent variables on dependent variables, and a multiple regression analysis is believed to be the best suited method for this purpose. Data from 'Survey of living conditions 1998' are used. It is a cross-sectional study of self-reported health. Out of the 3449 subjects interviewed, we made a selection of people aged 60 and above, so that the final number of respondents in our study ended up at 1 236 people. I wanted to investigate if level of education has an effect on morbidity and disability, controlling for age and gender. But more importantly, I attempt to test the possible connections between education and lifestyle, as well as the connection between lifestyle and health. The dependent variables used are: 1. Self-Assessed Health, 2. Actual Illness, 3. Chronic Illness, 4. Heart/Lung Disease, and 5. Disability. The independent variables are: 1. Education (to indicate SES), 2. Exercise, 3. Smoking, and 4. BMI. The last 3 variables indicate lifestyle. Unfortunately there are no variables describing dietary habits included in the 'Survey of living conditions 1998'. Regression of education, and the lifestyle and health variables, is straightforward. But the data set does not hold any valuable parameter of discounting. Therefore it is not possible to confirm my hypothesis about discounting as the explanatory link between education and lifestyle. But I choose to assume that a weaker inverse correlation between higher education and life-style related diseases/ chronic diseases, indicates an *indirect* effect, and that this indirect effect most likely occurs through future discounting. Also, a correlation between the lifestyle-related independent variables and the dependent variables will strengthen the discounting theory, even though it cannot confirm it. In the following sections I will first present the dependent variables and correlations between them, after which the independent variables are presented. Next, is a description of the selected statistical model, and in the last part of this chapter the results are discussed.

4.1 Dependent variables

Table 4.1 Dependent variables statistics

Statistics	Mean	Minimum	Maximum	Std. Deviation	Skewness	Kurtosis	Frequency		%
Self-Assessed Health	2,26	1,00	5,00	1,01	0,63	-0,18	1: Good	176	14
							2: Average/Good	316	26
							3: Average	156	13
							4: Average/Bad	83	7
							5:Bad	17	1
							Total	748	61
							Missing	488	39
								1236	100
Actual Illness	0,48	0,00	1,00	0,50	0,06	-2,00	No Illness (0)	637	51,5
							Illness (1)	599	48,5
							Total	1236	100
Chronic Illness	0,33	0,00	1,00	0,47	0,47	-1,45	No Chronic Illness (0)	833	67,39
							Chronic Illness (1)	403	32,61
							Total	1236	100
Heart/Lung Disease	1,70	1,00	2,00	0,46	-0,86	-1,26	No Heart/Lung Disease (2)	862	69,7
							Heart/Lung Disease (1)	374	30,3
							Total	1236	100
Disability	0,18	0,00	1,00	0,38	1,67	0,80	No Disability (0)	1014	82
							Disability (1)	222	18
							Total	1236	100

4.1.1 Self-Assessed Health

Respondents to the 'Survey of living conditions 1998' were asked to report on how healthy they feel. 748 answered on a scale from 1 to 5, 1 being the best and 5 being the worst. The average answer being 2.26 and a positive skew of 0.628, shows us that the majority of answers lie on the upper part of the scale; 1, 2 and 3, thus reporting that they feel relatively healthy, but that the answers of 4 and 5, raise the average above 2. The negative kurtosis value of -0.18 tells us that the distribution is a little flatter than a normal distribution is. The relatively large number of missing data is of course a weakness. In an attempt to include the missing data, I argue that it is reasonable to include them in the upper part of the scale, because those who do not answer such questions normally are those who feel healthy. Therefore, if any effect at all, the inclusion of the missing data would most likely push the average a bit down, i.e. feeling healthier.

Separate Boxplots of 'Self-Assessed Health' among women and men show that the mean and median is similar between genders, but the standard deviation is larger among men, the dispersion is larger among men compared to women who cluster around answer 2 and 3. A Scatterplot of age and self-assessed health, shows no immediate relationship between getting older and feeling unhealthy.

4.1.2 Actual Illness

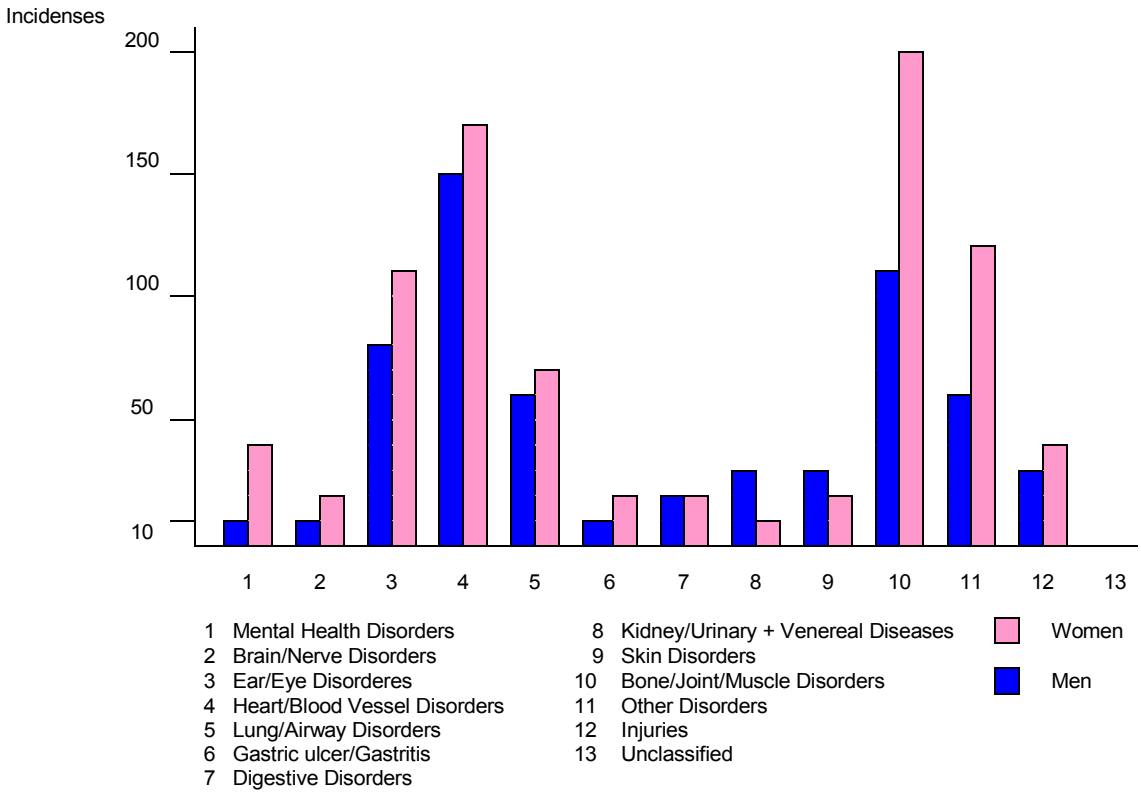
599 (48.5%) out of the 1236 respondents report of having one or more disease of some sort, based on lists of diseases presented to the subjects under the interview. The variable 'Actual Illness'(VARIGSYK) represents 'Chronic Illness' (SYKE1 =1) or 'Any Illness' (SYKE2 = 1), or both. Many of the respondents have several diseases. There are a total of 1454 cases of reported diseases among these 599 respondents, which means these 599 people have on average 2.43 diseases each. There are no missing data in 'Actual Illness'. Looking at the number of illnesses, we get that about 50% do have 2 or more diseases, many have 3 or 4 illnesses. It is known that having one disease increases the risk of having other diseases.

The number of individuals with disease is about the same as the number of individuals without a disease. We can see this by the frequency table, and it is shown by a skew value close to 0. Also the kurtosis of -2 indicates a flat distribution. There are 319 cases of heart disease, 187 cases of eye/ear disease, and 313 cases of muscle and skeleton diseases. Overall, the women in this population are more ill than men. Particularly in the categories 'Muscle and Skeleton' and 'Other Diseases' the number of cases is much higher among women than among men. Even in the case of heart diseases there is higher incidence among women than men. At the same time it may be noted that there are more women, and they are older than the men in this population.

Table 4.1 Incidences of actual illness

	Mental Disord.	Brain7Nerve Dirord.	Ear/Eye Disord.	Heart/Blood Vessel Disord.	Lung/Airway Disord.	Gastric Ulcer/ Gastritis	Digestive Disord.	Kidney/Urinary Tract Disord.	Skin Disord.	Bone/Joint/Muscle Disord.	Other Disord.	Injuries	Unclassified
Men	11	10	80	148	58	11	22	29	27	110	57	36	0
Women	40	20	107	171	67	18	21	16	24	203	125	43	0

Fig. 4.2 Incidences of actual illness



4.1.3 Chronic Illness

Out of 1236 respondents, 403 report of having a chronic or long-lasting illness (SYKE1). 176 (32.8%) men and 227 (32.4%) women in this group have chronic illness(s). The average age among the chronic ill is 72.1, which is a little lower than the overall average age. Average education level is 3.07 years after grade 6, which is higher than the overall average education level. This can be explained by the fact that these people are younger, and years of education have increased as time goes by, so that the younger you are the more education you have. Just as 'Actual Illness, 'Chronic Illness' is a dichotomous variable. But in this case

there is a less negative kurtosis and a positive skew, which means that the concentration of cases are higher on the left side (No Chronic Illness, 0) compared to the right side (Chronic Illness, 1).

4.1.4 Heart/Lung Disease

The dependent variable 'Heart/Lung Disease' is defined as those who have either a heart-related disease or a respiratory disease, or both. We know that 319 of the subjects have some sort of heart disease, and that 125 of the subjects have a respiratory-related disease. Therefore there must be 70 subjects who have both diseases, and the total number of subjects who have either one or both diseases sums up to 374. This dependent variable is also dichotomous, 1 indicating 'Heart/Lung Disease' and 2 indicating 'No Heart/Lung Disease'. The skew of -0.86 and the kurtosis of -1.26 reveals that there are more cases on the right side, that is 'No Heart/Lung Disease', and by a quite significant count.

4.1.5 Disability

'Disability' is a combined variable of the variables: H22A-Able to walk stairs, H24- Able to go shopping, H25-Able to clean the house, H26-Able to get dressed, H27-Daily personal hygiene, H28-Eat your own meal. 'Disability' is defined as answering no on one or more of these variables. All missing cases were categorized as 'No Disability' (answering yes). Out of 1236 subjects, only 222 are considered to be disabled. Thus, many cases (1014) are not disabled, resulting in a positive skew and a positive kurtosis.

4.2 Correlation between the dependent variables

The kind of correlation applied to one dichotomous variable and one continuous variable is point biserial correlation coefficient. It is mathematically equivalent to the Pearson correlation, so in the case of correlations between 'Self-Assessed Health' and the dichotomous variables, this method can be used. For correlation between two dichotomous variables we use phi square (Yaffee R.). There is obviously a correlation between 'Actual Illness' and both 'Heart/Lung Disease' and 'Chronic Illness', since having a heart/lung or chronic disease means you also belong to the 'Actual Illness' category. There is a significant

negative correlation between ‘Self-Assessed Health’ and ‘Heart/Lung Disease’ in such a way that having a heart or lung disease is correlated to worse self-assessed health. There is a positive and significant relationship between ‘Self-Assessed Health’ and the dependent variables ‘Actual illness’ and ‘Chronic Illness’. Having a chronic illness, or any illness, is associated with worse self-assessed health. So being ill and feeling ill are linked together, quite naturally, but the correlation says nothing about the causal effect, it may go on either direction, or be caused by a third variable. There is also a positive relationship between having worse self-assessed health and being disabled, but this relationship is not significant, and may have occurred by chance.

Table 4.3 Correlation results between Self-Assessed Health and Heart/Lung Disease

Correlations

		Self-Assessed Health	Heart/Lung Disease
Self-Assessed Health	Pearson Correlation	1.000	-.340**
	Sig. (2-tailed)		.000
	N	748.000	748
Heart/Lung Disease	Pearson Correlation	-.340**	1.000
	Sig. (2-tailed)	.000	
	N	748	1236.000

**. Correlation is significant at the 0.01 level (2-tailed).

There is a positive correlation between ‘Disability’ and all of the variables ‘Actual Illness’, ‘Chronic Illness’ and ‘Heart/Lung Disease’, which makes sense because it means being ill is associated with being disabled. However, none of them are significantly related (Asymp. Sig. of 0.064 in the case of Actual Illness), and therefore may be due to chance. Being disabled might be associated with other factors more so than with illness, just as illness does not necessarily mean you are disabled.

Table 4.4 Correlation results between Disability and Actual Illness

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	3.438[a]	1	.064		
Continuity Correction[b]	2.284	1	.131		
Likelihood Ratio	6.109	1	.013		
Fisher's Exact Test				.083	.047
Linear-by-Linear Association	3.425	1	.064		
N of Valid Cases	264				

a. 1 cells (25,0%) have expected count less than 5. The minimum expected count is 2,70.

b. Computed only for a 2x2 table

So far, we know that the dependent variables 'Self-Assessed Health', 'Actual Illness', 'Heart/Lung Disease' and 'Chronic Illness' move in the same direction and might be effected by the same independent variables. 'Disability' is not significantly correlated to any of the other dependent variables, and probably has a different explanation.

4.3 Independent variables

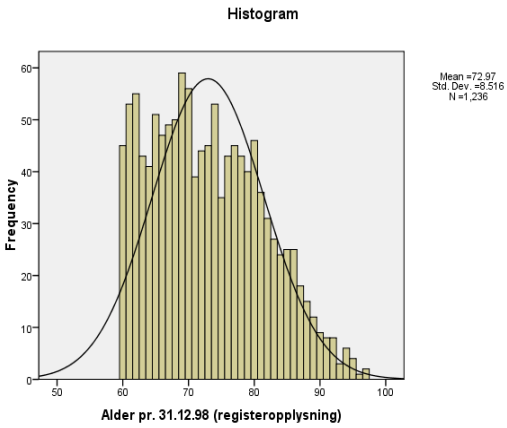
Table 4.5 Independent variables statistics

Statistics	Mean	Min.	Max.	Std. d.	Skewness	Kurtosis	Frequency		%
Age	72,97	60	97	8,52	0,39	-0,66			
Gender	1,57	1	2	0,50	-0,27	-1,93	Male	536	43,37
							Female	700	56,63
							Total	1236	100,00
Education	3,05	0	9	1,41	1,78	3,60			
Smoking	1,75	1	2	0,43	-1,17	-0,64	Smoker (1)	186	15,05
							Non-Smoker (2)	562	45,47
							Total	748	60,52
							Missing	488	39,48
								1236	100,00
Exercise	2,09	1	9	0,98	0,30	1,34	1	306	24,76
							2	74	5,99
							3	367	29,69
							Total	747	60,44
							Missing	489	39,56
								1236	100,00
BMI	25,16	14,34	192	5,57	21,94	651,49			

4.3.1 Age and Gender

A sample of people aged 60 and above was selected bringing the final number of respondents up to 1 236 people between 60 and 97 years of age, with an average age of 72.97. There is a similar and evenly age-distribution between men and women, apart from the fact that women are slightly older. There are 536 male respondents with an average age of 71.84, and 700 women with an average age of 73.84. As a comparison the life expectancy in 1946-50 was 69.3 and 72.7, respectively (ssb.no). The positive skew in 'Age' indicates a majority of individuals with an age to the left of the centre point. The kurtosis of -0.66 indicates a flatter than normal distribution. Considering 'Gender', the negative skew of -0.27 simply shows us that there are more females (2) than males (1) in this sample.

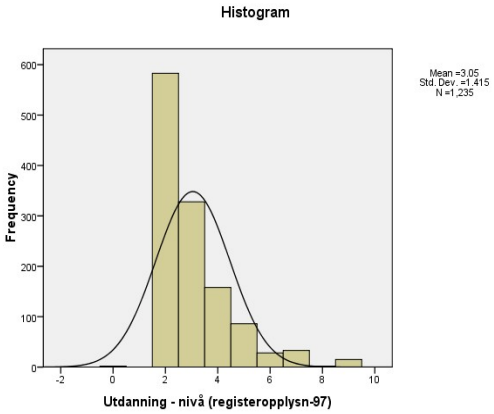
Fig. 4.3 Distribution of Age



4.3.2 Education

The educational level in this population ranges from zero to 9 years after grade 6, with an average level of 3.05. There is a positive skew of 0.39 and a positive kurtosis of 3.6, which means the mass lies to the left, more specifically quite centred at 2 and 3 years of education. However there is a difference between genders; the average level of education among men is 3.44, and the average education among women is 2.74. A lot of the respondents have 2 or 3 years after grade 6, which corresponds to the earlier educational system of the ”framhaldsskolen” -2 years or “realskole” – 3 years. Separate box-plots of the educational level for each gender show an interquartile range from 2 to 4 years and a median of 3 years of education after grade 6 for men, and an interquartile range from 2 to 3 with a median of 2 years of education after grade 6 for women. Education among men is thus quite evenly distributed. While among women there are a few with quite high education that pulls the average up.

Fig. 4.4 Distribution of Education



4.3.3 Smoking

Out of 748 respondents (341 men and 407 women) 562 are non-smokers. This is a large number compared to those who do smoke, and results in a negative skew of -1.17. 72 (21.1%) of the male population smoke daily and 17 smoke occasionally. 87 (21.4%) of the female population smoke daily, 10 smoke occasionally. Average education for a smoker is 3.13, and for non-smokers 3.25 years after grade 6.

4.3.4 Exercise

Out of 747 respondents, 306 report that they never exercise, 74 say they exercise once a week or less, 367 exercise more than once a week. The positive skew in 'Exercise' is a bit misleading because there is one case in category 9 (missing) included here. Leaving 9 out, the skew would change. The kurtosis is high, 1.34, and it tells us that the distribution is far from centred around one point. Actually, you either exercise more than once a week or you don't exercise at all. Few are in the middle category; exercise once a week. 185 out of 407 women (45.5%) exercise, and 182 out of 341 men (53.4%) exercise. Those who exercise have a lower average age, which can be explained by the fact that as you get older you tend to exercise less. The average education level for those who never exercise is 2.95 years, which is clearly lower than for those who exercise, but there is little difference between exercising once a week or less, and exercising more than once a week, 3.43 years and 3.41 years respectively. Those who exercise more than once a week also have slightly higher

income. This can be explained by the fact that those who exercise are also the younger ones, who may still work, thus the higher income.

4.3.5 BMI

Average BMI in this population of 1236 people is 25.16, which is just above the range of normal weight of 18.50-24.90. Recognizing that the age of this population is above 60, it is not surprising, since older people do on average weigh a little more than younger people. The standard deviation is only 5.573, even if the minimum registered BMI is only 14.343 and the maximum is the extreme value of 192. So, most cases lie within close range to the average. The extremely high kurtosis value also tells us about a very peaked distribution. The mass of the cases have a BMI to the left side of the distribution, which results in a positive skew of 21.94. A few extreme high values pull the average up.

4.4 Statistical model

The dependent variables; 'Actual illness', 'Chronic Illness', 'Heart/Lung Disease' and 'Disability', are all dichotomous variables and do not fulfil the conditions for least square methods. Ordinary Least Square (OLS) requires the dependent variable to be continuous, in addition to being linear, random and normally distributed. In the cases of the dichotomous variables I therefore use logistic regression instead, where the dependent variables are expressed in terms of Odds ratio; probabilities of being in one group or the other (Tufte P.A. 2000). In the case of "Self-Assessed Health" the correct statistical model should be ordered logit, because the dependent variable is on an ordinal level. The variable has more than two levels and can be ordered, but we are not certain about the 'distance' between the categories; whether the 'distance' between level 1(good health) and level 2 (good to average health) is the same or different from the distance between 2 (good to average health) and level 3 (average health). Ordered logistic regression simultaneously estimates multiple equations. The equations models the odds of being in category 1 compared to 2, in 2 compared to 3 etc. But there is only one set of coefficients in the model, so there is an assumption of a parallel regression. (Snedker et al. 2002). Both a multi-nominal and a linear regression were tried out on the dependent variable 'Self-Assessed Health', and the results were quite similar. The

linear regression model was chosen because it was easier to interpret, treating the variable as continuous on an interval level.

Skew is a measure of asymmetry of a dataset. The distribution is symmetrical if it looks the same on both sides of the centre-point. A negative skew means that the mass of the distribution is concentrated on the right and there is a long left tail. In such a case the mean is lower than the median, and the median is lower than the mode. This is expressed by a negative skewness coefficient. A positive skew means the mass of the distribution is concentrated on the left side with a tail to the right. Now the mean is higher than the median, and the median is higher than the mode. This is expressed by a positive skew coefficient (Newbold P. et al.). Kurtosis on the other hand, measures whether the data are peaked or flat. A peak near the mean with rapid declines and long tails, and thus a concentration of values around one point, gives us a positive kurtosis value. Conversely, as we approach uniform distribution the graph gets flatter, which result in negative kurtosis values. Value zero indicates a normal distribution. Skewness says something about the *location,* and kurtosis says something about the *variability* of the data set. Both are therefore valuable tools in explaining continuous variables. In relation to the dichotomous variables skew and kurtosis correspond to the frequencies, they only show us which of the two outcomes is the most common, and by how much.

4.5 Results

4.5.1 Self-Assessed Health

Table 4.6 Linear regression with Self-Assessed Health as the dependent variable

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.068	.431		4.802	.000
	Age	.012	.005	.090	2.430	.015
	Gender	.054	.076	.027	.712	.477
	Education	-.094	.026	-.139	-3.692	.000
	Smoking	-.148	.085	-.063	-1.745	.081
	Exercise	-.144	.038	-.139	-3.828	.000
	BMI	.005	.005	.037	1.046	.296

a. Dependent Variable: Self-assessed Health

1: Good Self-Assessed Health
2: Average/Good Self-Assessed Health
3: Average Self-Assessed Health
4: Average/Bad Self-Assessed Health
5: Bad Self-Assessed Health

Smoker = 1, Non-Smoker = 0

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.263[a]	.069	.062	.980

a. Predictors: (Constant), BMI, Gender, Smoking, Exercise, Age, Education

An adjusted R square of 0.062 means 6.2 % of the variation in 'Self-Assessed Health' is due to the independent variables in the model. And the regression shows us that the dependent variable most likely is predicted by 'Age', 'Education', and 'Exercise'. 'Age', 'Education' and 'Exercise' have a significance level of 5% (sig. < 0.05). 'Smoking' has a significance level of 10% (sig. <0.10).

There is a positive and significant relationship between 'Age' and 'Self-Assessed Health'. As 'Age' increases by one unit, health is considered 0.012 units worse (going from 1 towards 5), compared to the 'Self-Assessed Health' constant of 2.068 when 'Age' is not considered. [Self-Assessed Health = 2.068 + Age* 0.012]. Earlier we saw that women in this sample are on average older than men, but controlling for gender provides no significant relationship to 'Self-Assessed Health'. In other words, self-assessed health gets worse the older the person is, regardless of gender, and this is probably because their health actually is worse, considering we also found that there was a significant correlation between 'Self-Assessed Health' and 'Actual Illness'. However, self-assessed health may affect actual illness, just as actual illness may affect self-assessed health. There is a negative and significant relationship between 'Education' and 'Self-Assessed Health'. As 'Education' increases by one unit, health is considered as 0.095 units better. So far, this analysis corresponds to earlier findings and to the theory of this paper; the SES indicator education is associated with health, at least in terms of how healthy one *feels*. The causal relationship is not established, but it is quite likely that higher education has an impact on better self-assessed health, and not visa versa, because of the temporal precedence of the education dimension; these people probably have finished their education decades ago. Neither is there an explanation of *why* there is a relationship. Is it the increased knowledge associated with higher education that leads to a healthier lifestyle, and thus better self-assessed health, or is it the higher education that leads to a higher positioning in the hierarchy and a higher value that gives better self-assessed health? Perhaps it is both, or possibly it is the difference in discounting and thus a difference in healthy lifestyle, caused by difference in educational level. There is a negative and quite significant relationship between 'Smoking' and 'Self-Assessed Health' (the probability of the correlation not being statistically significant is below 0.081). As 'Smoking' increases, health is considered to be better. This can be explained by the fact that people tend to stop smoking when they get ill. There is a negative and significant relationship between

'Exercise' and 'Self-Assessed Health'. As 'Exercise' increases, their health is considered to be better. Again, the causal direction is inconclusive, and better self-assessed health can just as well cause increased exercise, as the other way around. This relationship may imply that those who are ill do not have the same opportunity to exercise. On the other hand, it may also strengthen our hypothesis that healthy lifestyle is part of the explanation of improved health and self-assessed health. Also, it is the better *self-assessed* health that is associated with increased time spent exercising. It tells us that feeling healthier can be linked to exercise, but not necessarily that we actually *are* healthier. There is no significant relationship between 'BMI' and 'Self-Assessed Health'.

4.5.2 Actual Illness

Table 4.7 Binary logistic regression with Actual Illness as dependent variable

Variables in the equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1	Age	.079	.014	29.368	1	.000	1.082
	Gender	.295	.199	2.179	1	.140	1.342
	Education	-.061	.062	.956	1	.328	.941
	Smoking	.105	.213	.243	1	.622	1.111
	Exercise	-.084	.100	.704	1	.401	.919
	BMI	.087	.029	8.926	1	.003	1.091
	Constant	-6.516	1.447	20.270	1	.000	.001

No disease = 0, any disease = 1
No smoking = 0, smoking = 1

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	694.052[a]	.068	.108

a. Estimation terminated at iteration number 5 because parameter estimates changed by less than ,001.

Considering 'Actual Illness', the regression analysis shows us that whether you have a disease (any type) or not is associated with age and BMI, when controlling for the other

independent variables. ‘Age’ and ‘BMI’ has a significance level of 5% (sig.< 0.05) None of the other independent variables have a significant impact on ‘Actual Illness’. The Nagelkerke R square of 0.108 means 10.8 % of the variation in ‘Actual Illness’ is due to the independent variables in the model.

There is a positive and significant relationship between ‘Age’ and ‘Actual Illness’. As ‘Age’ increases by one unit, the probability of being ill is 0.079 units higher, compared to the ‘Actual Illness’ constant of -6.516 when age is not considered [Actual Illness = -6.516 + Age* 0.079], but there is no significant relationship between ‘Gender’ and ‘Actual Illness’. It is a natural and logical tendency that older people have a higher probability of having diseases regardless of gender. It also corresponds to the relationship between self-assessed health and age/gender, found above. But when it comes to ‘Education’ there is not the same association to ‘Actual Illness’ as for ‘Self-Assessed Health’. There is a negative relationship, as expected, as ‘Education’ increases by one unit the chance of having any disease decreases by 0.061 units, but this relationship is not significant, and may have occurred by chance. Perhaps education, (and other SES variables), only has an impact on how healthy we *feel*, and perhaps how healthy we feel not only corresponds to how healthy we are? However, we found that ‘Actual Illness’ and ‘Self-Assessed Health’ correlate, and it is more likely that the explanation lies in that level of education affect only some types of illnesses, and that the significant level for ‘Actual Illness’ for that reason is weaker. There is a positive relationship between ‘Smoking’ and ‘Actual Illness’. As ‘Smoking’ increases, the chance of having any disease increases. But this association is not significant and we can not make an inference based on it. There is a negative relationship between ‘Exercise’ and ‘Actual Illness’. As ‘Exercise’ increases, the chance of having any disease decreases. There is also a positive and significant relationship between ‘BMI’ and ‘Actual Illness’. As ‘BMI’ increases, the chance of having any disease increases. Both associations are expected and in line with other studies; exercise and a lean body leads to better health. Again our hypothesis about the importance of a healthy lifestyle is strengthened. But the causal direction is not verified, which means we should not disregard the possibility that better health perhaps also leads to better opportunity to exercise and lower BMI.

4.5.3 Chronic Illness

Table 4.8 Binary logistic regression with 'Chronic Illness' as the dependent variable

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1	Age	.022	.010	4.716	1	.030	1.022
	Gender	.030	.157	.038	1	.846	1.031
	Education	-.112	.053	4.451	1	.035	.894
	Smoking	-.042	.176	.058	1	.810	.958
	Exercise	-.085	.078	1.174	1	.278	.919
	BMI	.039	.021	3.612	1	.057	1.040
	Constant	-1.835	1.041	3.107	1	.078	.160

No chronic disease = 0, Chronic disease = 1
No smoking = 0, smoking = 1

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	1012.759[a]	.026	.035

a. Estimation terminated at iteration number 5 because parameter estimates changed by less than ,001.

The Nagelkerke R square of 0.035, means 3.5 % of the variation in 'Chronic Illness' is due to the independent variables in the model. Except for 'Smoking', all the other variables affect 'Chronic Illness' as expected, but only 'Education', 'Age', and 'BMI' are significant. 'Age' and 'Education' have a significance level of 5% (sig.< 0.05), while 'BMI' has a significance level of 10% (sig.<0.10).

There is a positive and significant relationship between 'Age' and 'Chronic Illness'. Just as age predicts any illness, it also predicts chronic illness, specifically. As 'Age' increases by one unit, the probability of having a chronic disease is 0.022 units higher, compared to the 'Chronic Illness' constant of -1.835 when age is not considered. [Chronic Illness = -1.835 + Age* 0.022] Like the cases of 'Self-Assessed Health' and 'Actual Illness', 'Gender' has no

significant effect on ‘Chronic Illness’. There is a negative and significant relationship between ‘Education’ and ‘Chronic Illness’. As ‘Education’ increases by one unit, the chance of having a chronic disease decreases by 1.12 units. Assuming the causal direction is from ‘Education’ to ‘Chronic Illness’, education has a different effect on chronic disease compared to other diseases. This strengthens the hypothesis about discounting and lifestyle; education affects health, but significantly only in terms of chronic diseases, which are diseases that normally are associated with lifestyle. On the other hand, turning the causal direction around, some of these cases of chronic illness might have been contracted in early life, so that chronic illness has an impact on the decision about level of education. But since there is a significant causal effect of ‘Age’ on ‘Chronic Illness’ among these individuals aged 60 and above, one might argue that this applies only to a marginal portion of this population, or that it is probably not the case at all. When it comes to ‘Smoking’, there is the same surprising negative effect as in the case of ‘Self-Assessed Health’; as smoking increases, the chance of having chronic disease decreases. Again this relationship can be explained by the fact that people tend to stop smoking when they get ill. However the association in this regression is not significant. There is also a negative relationship between ‘Exercise’ and ‘Chronic Illness’. As ‘Exercise’ increases, the chance of having chronic disease decreases. But this association is not significant, either, and may have occurred by chance. There is a positive and significant relationship between ‘BMI’ and ‘Chronic Illness’. As ‘BMI’ increases, the chance of having a chronic disease increases. This is in accordance with earlier findings, and again it strengthens the connection health has to lifestyle, although the causal direction is not established.

4.5.4 Heart/Lung Diseases

Table 4.9 Binary logistic regression with Heart/Lung Diseases as the dependent variable

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1	Age	-.030	.010	8.837	1	.003	.970
	Gender	.144	.156	.850	1	.357	1.154
	Education	.038	.053	.531	1	.466	1.039
	Smoking	-.031	.174	.031	1	.859	.970
	Exercise	.054	.077	.492	1	.483	1.056
	BMI	-.004	.011	.159	1	.690	.996
	Constant	1.845	.894	4.261	1	.039	6.329

Heart/Lung Illness = 1, No Heart/Lung Illness = 2

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	1024.396[a]	.017	.022

a. Estimation terminated at iteration number 3 because parameter estimates changed by less than ,001.

Doing binary logistic regression of only heart diseases and respiratory diseases separately and combined, gives no significant association between disease and the independent variables, except for age. As 'Age' increases, the chance of having heart and/or lung diseases increase. The R square of 0.022 means 2.2 % of the variation in 'Heart/Lung Disease' is due to the independent variables in the model.

One might have expected a similar effect between 'Education' and 'Heart/Lung Disease' as we attained for 'Chronic Illness', since heart and lung diseases also to a large degree are associated with lifestyle. As expected the chance of getting heart/lung diseases decreases as education increases, but the effect is not significant. The occurrence of heart diseases is

normally associated with less exercise and higher BMI. In our regression analysis the probability of heart/lung diseases does in fact decrease as exercise increases and as BMI decreases. However neither of these relationships is significant.

4.5.5 Disability

Table 4.10 Binary logistic regression with Disability as the dependent variable

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1	Age	.080	.012	46.542	1	.000	1.084
	Gender	.273	.181	2.274	1	.132	1.314
	Education	-.053	.065	.676	1	.411	.948
	Smoking	-.189	.203	.867	1	.352	.828
	Exercise	-.338	.090	14.078	1	.000	.713
	BMI	.008	.012	.482	1	.488	1.008
	Constant	-6.135	1.036	35.048	1	.000	.002

Disabled = 1, Not disabled = 0
No smoking = 0, smoking = 1

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	821.379[a]	.111	.158

a. Estimation terminated at iteration number 4 because parameter estimates changed by less than ,001.

An R square of 0.158 means 15.8 % of the variation in 'Disability' is due to the independent variables in the model. As expected, 'Age' and 'Exercise' have a significant effect on 'Disability'. 'Age' and 'Exercise' have a significance level of 5% (sig. < 0.05), whereas none of the other associations are significant.

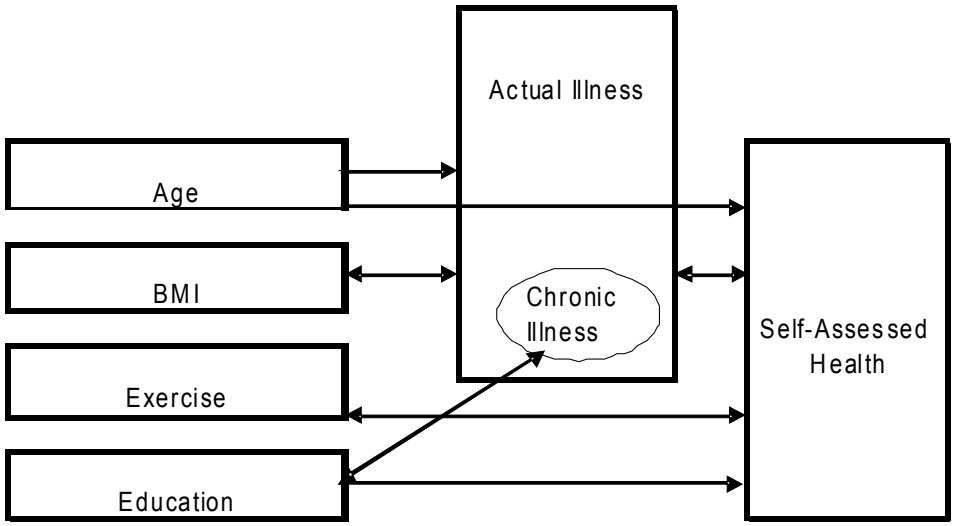
The effect of ‘Age’ on ‘Disability’ is positive and significant. As ‘Age’ increases by one unit, the probability of being disabled is 0.080 units higher, compared to the ‘Disability’ constant of -6.135 when age is not considered. [Disability = -6.135 + Age* 0.080]. ‘Gender’ has no significant effect on ‘Disability’. There is a negative relationship between ‘Education’ and ‘Disability’. As ‘Education’ increases by one unit, the chance of being disabled, decreases by 0.53 units, but the relationship is not significant. There is a negative relationship between ‘Smoking’ and ‘Disability’. As ‘Smoking’ increases, the chance of being disabled decreases, but the association in this regression is not significant, either. When it comes to ‘Exercise’ there is a negative and significant association to ‘Disability’. As ‘Exercise’ increase, the chance of being disabled decreases. This association corresponds to previous knowledge about the preventive effect that exercise has on disability. At the same time, disability will, in many cases, necessarily be an obstacle for exercise, and the causal direction is therefore ambiguous. Also ‘BMI’ has a positive correlation to ‘Disability’, in this regression analysis, but the effect is not significant.

In our correlation between the dependent variables earlier, we found that ‘Disability’ did not correlate with the other dependent variables, and it is therefore reasonable to think that the degree of disability is to a large extent explained by other factors than to illness, even though there are some common factors.

4.5.6 Summary –regression results

Based on the correlation between the dependent variables and the subsequent regression analysis, we can assume that the variables ‘Self-Assessed Health’, ‘Actual Illness’, ‘Chronic Illness’ and ‘Heart/Lung Disease’ move in the same direction and probably are affected by the same independent variables. Moreover, we can assume that there is a causal effect between ‘Actual Illness’ (including chronic illness and heart/lung diseases), and ‘Self-Assessed Health’. A summary of the causal effects obtained through the regression analysis can be presented in a causal model as follows:

Fig. 4.5 Causal model of the associations obtained



5. DISCUSSION AND CONCLUSION

5.1 Results

The aim of this study was to show that level of education has a causal gradient effect, not only on mortality, but also on morbidity. The hypothesis is that the gradient effect appears both through the psychological factor of feeling successful (Marmot 2004), but also, and possibly more so, through discounting the future, self-efficacy and its effect on lifestyle; both the knowledge about it and how we act upon it, and subsequently its effect on actual health.

The regression analysis performed on 'Self-Assessed Health' provides support for the theory concerning a health gradient. Controlling for other significant independent variables, level of education itself predicts self-assessed health. This finding is consistent with the study 'Socio-economic inequalities in mortality and morbidity: a cross-European perspective (J.Mackenbach et al. 2007)' mentioned earlier. In the same way that mortality is affected by SES, morbidity is also higher in lower SES groups, although not to the same degree. Nonetheless, it explains a psychological effect, given the fact that the differences are equally large in egalitarian countries as for other countries. By the fact of being an egalitarian country, materialistic explanatory factors are omitted, to a larger extent. Other studies such as 'Health inequalities according to educational level in different welfare regimes: a comparison of 23 European countries (Eikemo et al. 2007)' have found that educational level, in particular, has a smaller effect on health inequalities in the egalitarian countries, but the difference is still there. Evidence for the social gradient in health has been provided repeatedly through numerous studies. Further, the causal effect of 'Exercise' on 'Self-Assessed Health' indicates a link between the social gradient of health and lifestyle. According to the study 'socioeconomic inequalities in leisure-time physical activity (S.Demarest et al.2007)' distinct socioeconomic differences can be observed in lifestyle. Reports from WHO come to the same conclusions. Also, in terms of smoking, drinking and dietary habits there are clear differences according to SES. At the same time, we should be open to the possibility that the connection between 'Self-Assessed Health' and 'Actual

Illness' is such that 'Self-Assessed Health' affects 'Actual Illness' by a psychological factor. This finding fits into the theory that higher education leads to increased feeling of success and self-efficacy, and that this in turn leads to less discounting of the future and a better lifestyle, and thus better health. Through our regression analysis on 'Actual Illness' and 'Chronic Illness', we found that level of education most likely has a causal effect on morbidity only with regard to chronic diseases. This causal relationship is consistent with our theory that says the differences can be partially explained in terms of lifestyle, since chronic illnesses to a large degree can be explained by lifestyle. If we had the opportunity to include dietary habits in the model, I think this variable would also predict chronic disease. Nonetheless, the controlling for 'Exercise' and 'BMI' indicates that these variables affect health, but also that education alone has an affect on chronic illness, which provides evidence for the psychological explanation. It stands in contrast to the findings of the study 'Contribution of specific causes of death to educational differences in mortality' where findings revealed a social gradient across most diseases, which supports the general susceptibility theory. On the other hand, they also found that the gradient for chronic lung diseases, heart diseases and alcohol related diseases was steeper. The fact that no causal relationship was found between 'Education' and 'Heart/Lung Disease' in our regression analysis weakens our theory on the connection between lifestyle and SES, since lifestyle is known to be a considerable contributor to heart/lung diseases as well. If chronic illnesses are defined as consisting of heart/lung diseases, cancer and diabetes, as WHO does, it might look as if it is mainly the chronic diseases of cancer and diabetes that are affected by level of education. But this is very uncertain, since we do not have other definitions of chronic disease in this dataset, other than the illness being long-lasting. The category of 'Chronic Illness' does not distinguish between types of illnesses.

A major challenge is to explain *why* there is a gradient difference in lifestyle based on level of education. The regression analysis gives little in terms of any certain answers here, but I believe the studies on discounting provide us with reasonable explanations. Studies like 'Life expectancy, economic inequality, homicide, and reproductive timing in Chicago neighbourhoods (Daly M, Wilson M. 1997)' showing the steeper discounting among lower SES groups, provide support of the gradient difference in lifestyle based on SES.

5.2 Limitations

There are several limitations in the data set used. The choice of using 'Smoking', 'Exercise' and 'BMI' as indicators of lifestyle may be insufficient. Dietary habits is probably a more suitable indicator of lifestyle, and would have been included if it was available. 'Education' was chosen as the parameter for SES for obvious reasons, but limiting the sample to people over 60, clusters the data, and the results become less clear. In addition to the fact that those who have already died before the age of 60 (healthy or ill), are not included in the sample. Obviously some diseases 'last' longer. There are also problems related to the indicators of health. Due to the fact that the data are self-reported, there is a possibility that 'Self-Assessed Health' is interpreted differently among individuals according to level of education, thus giving an unfavourable effect on the results. However, the correlation between 'Self-Assessed Health' and 'Actual Illness', strengthens the validity. Another weakness is the definition of 'Chronic Illness' as long-lasting disease, which not necessarily is equal to lifestyle-related disease. Thus, our findings concerning lifestyle and lifestyle-related diseases become weaker. Also, the large amount of missing cases in 'Disability' is a cause of concern. We define missing cases as equal to 'No Disability', which might be a faulty assumption.

There are also limitations concerning causality. While some variables, such as 'Age' and 'Education', cause little or no problem, other variables provide ambiguous results. For instance, although 'Exercise' and 'Smoking' may have a causal effect on health, the causal effect might as well go in the opposite direction.

5.3 Conclusion

Through the regression analysis, we have found that there is a link between lower education, less exercise, higher BMI, and more chronic illness. These findings support the hypothesis, that education predicts morbidity, but more so by the indirect effect, than by the direct effect. The significant associations only appearing through the regression analysis of chronic diseases, shows us that the health differences among SES groups appear mainly because of differences in lifestyle, possibly initiated by a difference in discounting, which leads to

differences in the prevalence of chronic disease, more than other diseases. It supports the indirect effect of the hypothesis of this paper, and that perhaps there has been placed too much emphasis on the direct effect; that Marmots theory about the effect of 'your place in the hierarchy' per se, is overestimated.

The reduction of socioeconomic inequalities in health is a priority for policy makers in Norway. If, in fact, discounting, self-efficacy and lifestyle are contributing to socioeconomic inequalities in health, it has implications for the entry-point of policy. In that case, interventions need to be directed towards a micro-level. In addition to information about the advantages of leading a healthy lifestyle, we need to influence people's view of the future. There is a potential health gain of improving overall lifestyle habits, particularly among lower SES groups. Therefore, we need incentives for such a lifestyle, and the means of improving people's self-efficacy. We need to promote the favourable outcome of exercise and healthy diet, and the downside of smoking and drinking excessively, and to emphasize that the health-gain it provides seldom has an instant effect, but appears in the future. Hence, it is of vital importance to promote a future-oriented view among lower SES groups. Also, it is necessary to focus on prevention, because of the amplified problem of quitting bad consumption-habits once started.

It would be interesting to lengthen this study into a longitudinal study, for the possibility of establishing stronger causal associations. Aware of the fact that this study lacks a good parameter of discounting, one could also wish for a data-set containing such a variable, together with lifestyle-variables including dietary habits. It would be interesting to investigate whether there is a correlation between those individuals concerned with leading a healthy lifestyle and degree of discounting of the future. Another direction for future research could be to look at discounting of the future and its correlation to particular groups of people who clearly perceive the future effects of their present actions. For example, I imagine politicians must feel they can influence and make a difference, hence being future-oriented. Regardless of level of education, do these people, in fact, discount the future more than others? And, are they more or less concerned with living healthy lives?

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